Aug. 4, 1964 E. M. KATCHMAR ET AL 3,143,586

STOCKLINE CURTAIN FOR BLAST FURNACE

Filed April 17, 1962

FIG. 1

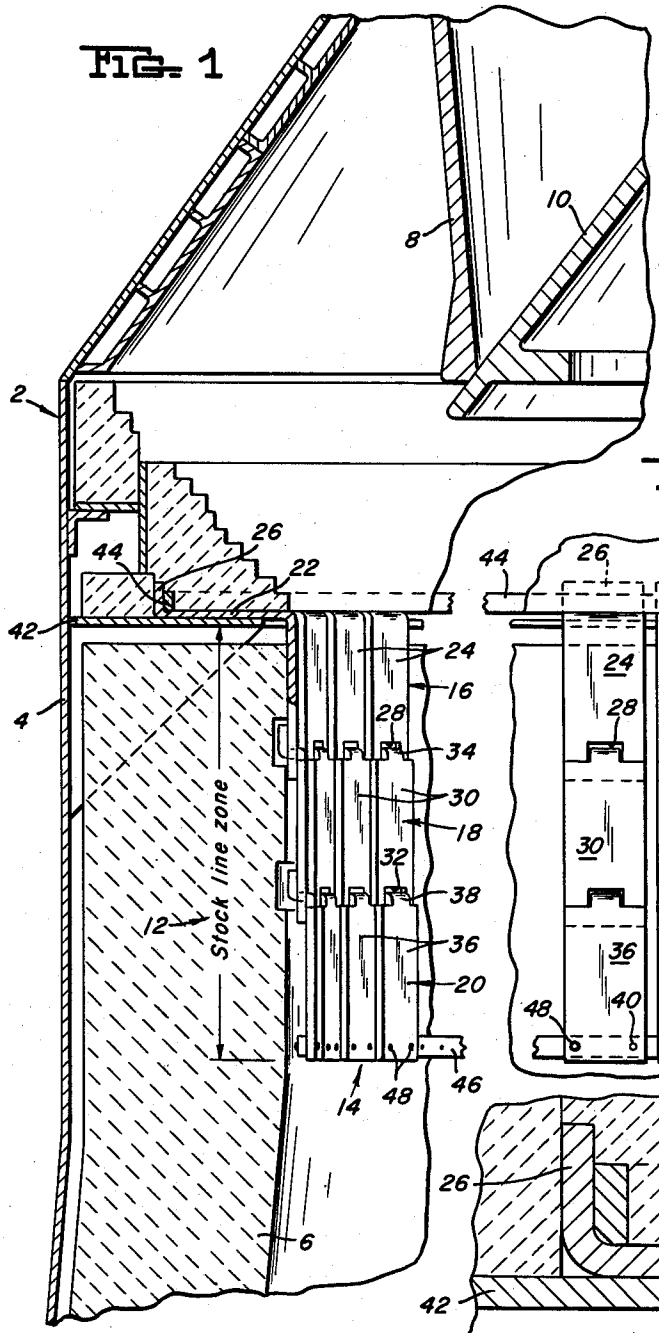


FIG. 4

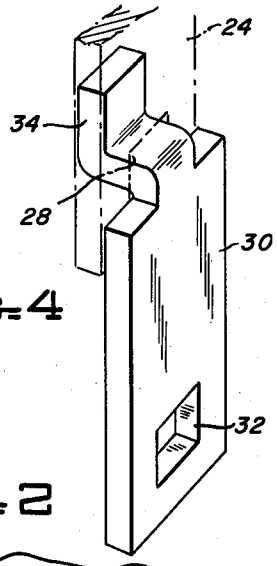


FIG. 2

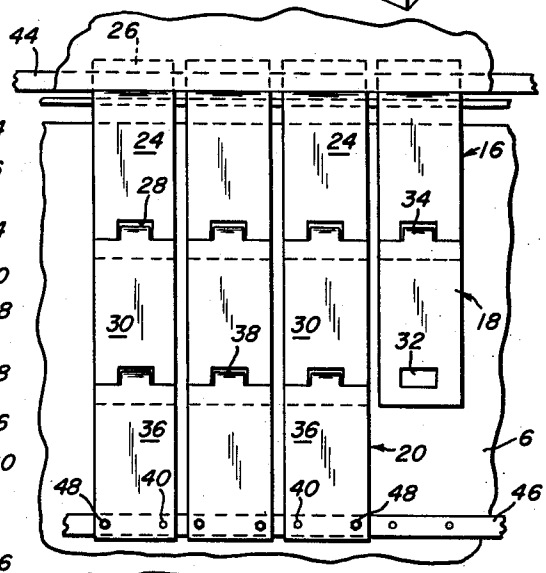
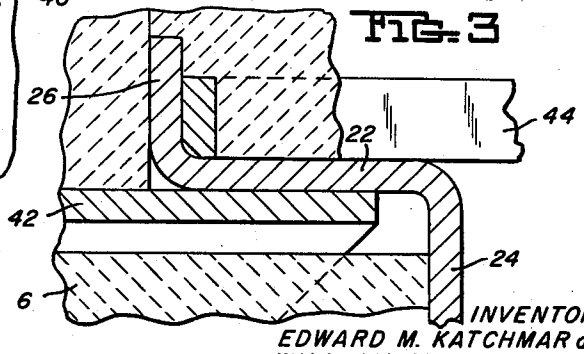


FIG. 3



INVENTORS
EDWARD M. KATCHMAR and
WILLIAM STANFORD
By Donald G. Dalton Attorney

United States Patent Office

3,143,586
Patented Aug. 4, 1964

3,143,586

STOCKLINE CURTAIN FOR BLAST FURNACE

Edward M. Katchmar, 10909 Ave. C, Chicago, Ill., and William Stanford, 314 Cleveland St., Gary, Ind.

Filed Apr. 17, 1962, Ser. No. 188,127
4 Claims. (Cl. 266—31)

The present invention relates generally to blast furnaces of the type used for producing pig iron and more particularly to an improved protective curtain for the stockline zone of the refractory linings of such furnaces.

Conventional blast furnaces are constructed with a metallic shell lined with refractory. The top of the furnace is provided with a hopper and a large bell whereby raw materials are charged into the furnace. The raw materials are first dumped into the hopper onto the large bell which closes the bottom of the hopper. The bell is then lowered to open the hopper and permit the raw materials to drop into the interior of the furnace. As the raw materials drop from the hopper they are deflected by the bell outwardly against the upper portion of the inner face of the refractory lining of the furnace. This upper portion of the refractory lining is known as the "stockline zone." The deflection of the raw materials against the stockline zone during charging of the furnace causes rapid wear of this portion of the furnace lining unless protective wear-resistant shields are provided. Prior to our invention such shields were in the form of metallic plates each having a short downwardly turned flange at one end and a short upwardly turned flange at its other end. The plates were imbedded in rows between adjacent horizontal courses of refractory in the stockline zone of the furnace lining around the inner periphery of the lining with their downturned ends overlaying a course of refractory. Thus, the downturned end flanges of the plates in each row protected the refractory brick lining from the abrasive action of the raw material falling upon it.

There were serious disadvantages inherent in this prior art practice of protecting the furnace lining, for example, a large number of plates were required to provide even minimum protection to the furnace lining. The large number of plates required together with the fact that each plate had to be individually handled when building the stockline zone lining made the lining operation more time consuming and costly. Also, the aggregate weight of the plates was disproportionally large compared to the portion of each plate actually providing protection to the lining. Another serious disadvantage arose from the fact that the insertion of numerous plates between the horizontal courses of the stockline zone prevented a solid bond of the refractory in this area of the lining. Further, when the lining below the bottom row of plates eroded sufficiently to loosen the plates, the remainder of the lining thereabove was loosened and frequently disintegrated.

It is, accordingly, the primary object of our invention to provide an improved stockline zone protective curtain for a blast furnace lining which is made up of metal plates overlying the inner face of the stockline zone including a single row of plates imbedded in the stockline zone refractory adjacent the upper end thereof and rows of plates suspended from the single row but not imbedded in the refractory.

It is another object of our invention to provide a protective curtain as set forth by the object above wherein the major portions of the surfaces of the metal plates are utilized to protect the furnace lining.

It is a further object of our invention to provide a protective curtain of the character set forth in the above objects wherein the suspended plates are supported in a unique manner which prevents buckling of the curtain due to expansion of the plates.

These and other objects will become more apparent after referring to the following specification and attached drawings, in which:

FIGURE 1 is a partial vertical sectional view of a blast furnace having the curtain of the invention installed therein;

FIGURE 2 is a fragmentary front elevational view of the curtain of the invention;

FIGURE 3 is an enlarged detail view of a portion of FIGURE 1; and

FIGURE 4 is a perspectvie view showing a plate of the curtain of the invention and the manner in which it is suspended.

Referring more particularly to the drawing, reference numeral **2** designates generally a blast furnace having an outer metallic shell **4**, a refractory lining **6**, a hopper **8** and large bell **10**. The stock line zone of the refractory lining **6** is designated **12**.

The structure thus far described is conventional and is not claimed as our invention, the details of which will now be described.

The protective curtain of the invention is designated generally by reference numeral **14** and is composed of three horizontal rows **16**, **18** and **20** of metal plates which extend circumferentially around and overlay the inner face of the stockline zone of the furnace lining.

The plates in the top row **16** are angular in shape, each having a horizontal leg **22**, a long vertical leg **24** depending normal to one end of the horizontal leg, and a short vertical flange **26** projecting upwardly normal to the opposite end of the horizontal leg. Legs **24** overlay the upper portion of the inner face of the stockline zone. Each of the vertical legs **24** is provided with a generally rectangular opening **28** therethrough adjacent its bottom end.

The intermediate row **18** is made up of metal plates **30** each of which is rectangular in plan and provided with a generally rectangular opening **32** therethrough adjacent its bottom end. The upper end of each of the intermediate plates **30** is provided with a centrally located offset-tongue **34** projecting upwardly therefrom.

The bottom row **20** is comprised of metal plates **36** each of which is rectangular in plan. An upwardly projecting offset-tongue **38** projects upwardly centrally of the upper edge of each of the bottom plates **36**. A pair of bolt holes **40** are provided in each bottom plate **36** adjacent its bottom end.

The curtain **14** is installed in the furnace lining by means of circular support bracket **42** which is secured to the furnace shell **4** at the top of the stock line zone of the furnace lining. Bracket **42** provides a support shelf on which the horizontal legs **22** of the top row plates are seated with the vertical legs **24** extending downwardly over the inner face of the stockline zone. A lock ring **44** made up of arc segments is disposed on the horizontal legs **22** of the top row plates bearing against the upturned flanges **26** thereby securing the top row plates in place. The top courses of the stockline zone of the furnace lining are laid on the support bracket **42** and the horizontal legs **22** so that the top row plates are firmly anchored.

The offset-tongue **34** of each intermediate row plate is inserted through the rectangular opening **28** of the adjacent top so that when the intermediate row plate assumes vertical position overlaying the inner face of the stockline zone, the weight of the intermediate row plate causes the end portion of the offset-tongue **34** to engage the portion of the adjacent top row plate immediately above the rectangular opening **28** while the intermediate portion of the offset-tongue **34** is supported in the rectangular opening thereby providing a releasable connection between the top row and intermediate row plates. All of the plates

of the intermediate and bottom rows of the curtain 14 are hung in this manner from the next above aligned plate.

The bottom row plates 36 are secured to a ring 46 by means of bolts 48 which extend through bolt holes 40 in the bottom edges of plates 36 and suitable bolt holes in the ring 46 thereby holding the bottom plates 36 in fixed alignment.

The openings 28 and 32 are larger than the cross-sectional areas of the offset-tongues 34 and 38, respectively, to provide clearance so expansion of the plates due to heat will not result in buckling of the curtain. As best shown in FIGURE 2, the vertical rows of plates are spaced apart laterally to also provide clearance for expansion and prevent buckling.

Thus, the arrangement of the invention provides a rigid protective curtain for the stockline zone of a blast furnace lining to protect it from the shock and abrasive action of the falling raw material being charged into the furnace. The unique manner in which the curtain of the invention is supported eliminates any detrimental effect on the bonding of the refractory in the stockline zone. The novel support arrangement for the wear plates of the curtain of the invention prevents loss of wear plates in the event there is any break-up or caving-in of the furnace lining. It will be obvious that the amount of material, labor and time required for the installation of the curtain of the invention is considerably less than that required for protective shields of prior art design. The prior art shield described hereinabove required the use of 720 plates of high carbon steel, each weighing approximately 138 pounds for a total weight of 99,360 pounds for typical blast furnace installation. For the same blast furnace, the curtain of the invention requires 60 plates of high carbon steel, each weighing approximately 475 pounds for a total weight of only 28,500 pounds. This results in a saving of approximately 70,860 pounds or 35½ tons of high carbon steel through the use of the curtain of the invention. The consequent savings in labor and time are obvious.

While one embodiment of our invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. In a blast furnace having an outer shell, and a refractory lining in said shell having a stockline zone on its inner face, the improvement therewith of a protective wear-resistant curtain for the stockline zone of said refractory lining which comprises a plurality of angular-shaped metallic plates arranged in side-by-side relation circumferentially of the inner face of said refractory lining in said stockline zone, each of said plates having a horizontal leg imbedded in said refractory lining and a vertical leg depending from said horizontal leg and overlaying the inner face of said refractory lining in said stockline zone, each of said vertical legs having an opening therethrough adjacent the bottom thereof, an elongated metallic plate having an offset-tongue end attached to and depending from the vertical leg of each of said angular plates, the offset-tongue ends of said elongated plates being inserted in the openings of said vertical legs, and a ring surrounding said elongated plates adjacent the bottoms thereof, said elongated plates being attached to said ring.

2. In a blast furnace having an outer shell, and a refractory lining in said shell having a stockline zone on its inner face, the improvement therewith of a protective wear-resistant curtain for the stockline zone of said refractory lining which comprises a plurality of angular-shaped metallic plates arranged in side-by-side relation circumferentially of the inner face of said refractory lining in said stockline zone, each of said plates having a horizontal leg imbedded in said refractory lining and a vertical leg depending from said horizontal leg and overlaying the inner face of said refractory lining in said stockline zone, the horizontal leg of each of said angular plates having an upturned portion on the end thereof remote from said vertical leg, a locking ring disposed on the horizontal legs of said angular-shaped plates and bearing against the upturned portions of said horizontal legs, said upturned portions and said locking ring being imbedded in said refractory lining with said horizontal legs, each of said vertical legs having an opening therethrough adjacent the bottom thereof, and an elongated metallic plate having an offset-tongue end attached to and depending from the vertical leg of each of said angular plates, the offset-tongue ends of said elongated plates being inserted in the openings of said vertical legs.

3. In a blast furnace having an outer shell, and a refractory lining in said shell having a stockline zone on its inner face, the improvement therewith of a protective wear-resistant curtain for the stockline zone of said refractory lining which comprises a support bracket attached to and projecting normal to the inner surface of said blast furnace shell coaxially therewith adjacent the top of the stockline zone of said refractory lining, a plurality of angular-shaped metallic plates arranged in side-by-side relation circumferentially of the inner face of said refractory lining in said stockline zone, each of said plates having a horizontal leg imbedded in said refractory lining and a vertical leg depending from said horizontal leg and overlaying the inner face of said refractory lining in said stockline zone, the horizontal legs of said angular plates resting on and being supported by said support bracket, each of said vertical legs having an opening therethrough adjacent the bottom thereof, and an elongated metallic plate having an offset-tongue end attached to and depending from the vertical leg of each of said angular plates, the offset-tongue ends of said elongated plates being inserted in the openings of said vertical legs.

4. In a blast furnace having an outer shell, and a refractory lining in said shell having a stockline zone on its inner face, the improvement therewith of a protective wear-resistant curtain for the stockline zone of said refractory lining which comprises a plurality of angular-shaped metallic plates arranged in side-by-side relation circumferentially of the inner face of said refractory lining in said stockline zone, each of said plates having a horizontal leg imbedded in said refractory lining and a vertical leg depending from said horizontal leg and overlaying the inner face of said refractory lining in said stockline zone, each of said vertical legs having an opening therethrough adjacent the bottom thereof, and an elongated metallic plate having an offset-tongue end attached to and depending from the vertical leg of each of said angular plates, the offset-tongue ends of said elongated plates being inserted in the openings of said vertical legs, the opening in the vertical leg of each of said angular plates being larger than the cross-sectional area of the offset-tongue end inserted therein.

References Cited in the file of this patent

UNITED STATES PATENTS

505,538	Sheedy et al.	Sept. 26, 1893
915,601	Hine et al.	Mar. 16, 1909
1,709,823	Kennedy	Apr. 16, 1929
1,996,784	Zimmerman	Apr. 9, 1935
2,486,348	Wehr	Oct. 25, 1949
3,009,691	Tsujihata	Nov. 21, 1961